

IPM

Integrated pest management for K-12 turf managers

INTEGRATED PEST MANAGEMENT (IPM)—if you search the web you will find no less than 15 definitions and nearly as many suggestions for how to develop a program. There are multiple thoughts and perspectives on the importance and strategy of IPM. No wonder we struggled, early on, to define our goals and chart a course of action for our school district.

Fortunately we were able to work closely with extension experts, Dr. Dave Shetlar and Pam Sherratt of Ohio State's turfgrass science team to network, share ideas and gain an understanding of IPM and what we needed to do to implement an effective program for school grounds.

Along the way, we came to realize that implementing an effective IPM program was going to require a shift in thinking from a "that's the way we've always done it" or "that's the way they do it" mindset to one that asks questions like: "Why do we do it this way?", "What should we do?", "What are the benefits?", "What are the risks?", "Who does it affect?" and "What are all the options?". In Dr. Shetlar's words, "...the real heart of IPM is that it is a decision-making PROCESS. You have to think, ask questions and make decisions."

We have learned a few things as we have developed our IPM program here at Westerville City (OH) schools. My intent is not to teach you great truths that you've never heard before or impress you with the

intricacies of plant and pest physiology. Most of you are probably already practicing many of the techniques that make for an effective IPM program anyway. Hopefully you can take from our experience and perspective something that will benefit your own programs.

When we began developing our program more than 7 years ago, there was no law that said we had to. IPM was mandated for school districts under Ohio law for a short time in 2008 but funding issues caused its repeal. Our Director of Business Services, Jeff LeRose, coaches his people to always be looking to do what is right for the students, staff and community that we serve. Since student health and safety is a priority in our district, providing safe, well-maintained facilities by controlling harmful pests in a least toxic, most effective way is the right thing to do. We do IPM because we are in the people business and people do matter.

It has been our goal to create a non-disposable, user-friendly program; one that can be shared with others and that doesn't make sense not to use. It has also been our desire to reduce chemical use and provide safe, durable playing surfaces. It has taken cooperation from administrators, buildings, grounds and custodial staff, teachers, university extension, vendors and parents to create this type of program. Additionally, we contract with an IPM-gearred pest control service to help coordinate our program and provide annual inspections of our facilities.

At times, we have moved forward at a fast pace and developed segments of the program rather quickly; at other times we have moved at a snail's pace, sometimes struggling to determine what the next step should be. The key is to keep moving forward to reach our goals, always remembering that this, like anything we develop, is a process and that it will require time, patience and a desire to continually improve our systems.

There are a few components of our program that are common to our both our structural and grounds areas. These include: performing site assessments to determine what pests may need managed and what types of controls would be used; establishing threshold levels; regular monitoring to determine if pests are present, if they have exceeded threshold levels and whether controls are



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effective and are needed; educating ourselves and those we serve on the practices and mindset of IPM; and planning and implementing improvements to the program.

Focusing on the turf side of things, there are many common cultural practices that we employ in order to build dense stands of turf that can resist pest pressure and are safe for play. Examples include:

- Selecting suitable grasses and plant materials that are pest and drought resistance, and wear tolerant
- Using proper mowing techniques (follow the 1/3 rule, keep sharp blades, use higher [3 inches] mowing heights)
- Aeration or de-compaction to keep the soil loose to allow water and air to the roots, giving them room to grow
- Proper fertilization based on bi-annual soil tests and plant health
- Irrigation and water management—not too much, not too little while monitoring for plant needs. Areas where water stays too long are addressed by grading, drainage and soil modifications
- Seeding; generous amounts anywhere turf is thin with good seed to soil contact and mulching for protection on bare ground. Light, frequent irrigation to encourage germination and non-irrigated areas planted during best window for your region. We use predominantly turf type tall fescues due to their durability and drought resistance
- Try new things: we often plant high traffic playground fields with turf varieties that we want to test for wear tolerance; we look for varieties that hold up to high traffic with minimal maintenance. Our current tests include bermudagrass, hybrid bluegrass and growth regulator effects.

The control options we have available to use in managing pests are an important part of our IPM program. Each pest concern is evaluated by members of our grounds crew and other individuals we work with who are trained in IPM practices. They are charged

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with picking control options that are least toxic and most effective when it is determined that controls are warranted. The team also evaluates control options based on the permanency of their effect.

Examples of our most common control options include:

- Mechanical control; removal by hand, string trimming, mowing
- Natural control; endophytic grasses that are resistant to pests & composts
- Biological control; growth regulators are the only item we use in

this area currently, although we are beginning to work with one of our high school science departments as they experiment with compost teas.

- Habitat modification; eliminating sources of food, shelter and water that a pest would need to survive, e.g., renovating to remove pockets of standing water which in turn can reduce mosquito populations
- Chemical control; used judiciously for targeted, spot applications where other control options cannot provide the needed control in a least toxic, most effective manner; products with the lowest possible toxicity and highest effectiveness are chosen; when possible, applications are planned for periods when the pest can be treated with the lowest dose rate.

While these practices have helped us reduce chemical use, create better fields and facilities, make informed decisions and earn the IPM Institute's STAR Award, they do not tell the whole story of our success as a ground team or a school district. There are a few other "people" practices that are central to our process as we seek to educate others in our district about the importance of IPM practices and gain their cooperation.

These include:

- Relational practices like sharing, communicating, networking, getting along with others, and building relationship bridges

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- Organizational skills like time management, developing standardized procedures, using technology, planning ahead, managing resources, focus
- Education: knowing our stuff, always be learning, attend conferences and field days, work with university extension staff, use university research websites, and STMA resources.
- Professional practices such as project a good image, reach out to others, build trust, and add value to the team.

At the end of the day, IPM is important because people are important. They matter; each and every one of them. How we manage the tools, resources and ideas we have at hand can help others or hurt them. The right thing to do is to help them. After all, isn't that how we want them to treat us? ■

Kenny Nichols is head of grounds maintenance for the Westerville City Schools, Westerville, OH and a board member of the Ohio Sports Turf Managers Association, www.ostma.org.



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» **THE 25,000 SEAT** Red Bull Arena, located on the Passaic River north of Newark, NJ, is considered state-of-the-art for soccer stadiums in North America.

A soil profile: Red Bull Arena

The Soil Profile is a quarterly interview series that will be accompanied by soil test audits of a selected field from all corners of the sports turf world. Our goal is to evaluate the soil and water tests from a selected sports field and build a fertility program based on the soil profile. We encourage any sports field managers who would like to be interviewed for this piece to contact the editor at eschroder@m2media360.com. Joel Simmons is an agronomist who has been building soil based programs for more than 20 years. Along with Logan Labs he will provide free soil test work and consulting to the selected site.

DAN SHEMESH is the Director of Grounds at the new Red Bull Arena in Harrison, NJ, home of the Major League Soccer New York Red Bulls. Dan holds a degree in turf management from Penn State and after graduation had the opportunity to work with Tony Leonard at the Philadelphia Eagles' Lincoln Financial Field.

The stadium opened its doors March 20 and the schedule does not slow down much until the end of the fall and will include 15 home games for the Red Bulls, a number of international games, NCAA games and even a few

Water Analysis Report

pH		7.6		
Hardness ppm		61.8		
Hardness Grains		3.61		
Conductivity mmhos/cm		0.31		
Sodium Adsorption Ratio		1.28		
		ppm	MEQ/L	lbs/A IN
Calcium	Ca	16	0.80	3.64
Magnesium	Mg	5.3	0.44	1.20
Potassium	K	1.2	0.03	0.27
Sodium	Na	29.6	1.29	6.74
Iron	Fe	0.3		0.08
			MEQ/L	lbs/A IN
Total Alkalinity		43.0		9.77
Carbonate		0.0	0.00	0.00
Bicarbonate		52.0	0.85	11.82
Chloride		20.0	0.57	4.55
Sulfate		20.6	0.43	4.68
Salt Concentration		198.4		45.09
Boron		< 0.02		
Cation/Anion Ratio			1.38	

Figure 1

rugby matches not to mention a possible concert or two.

The field was built in the summer of 2009 and constructed with a 90/10 mix of sand and peat moss. The grass is 100% Kentucky bluegrass and was laid as sod last fall. One of the biggest challenges that Dan will face is the stadium itself in that the overhang structure does not allow for much in the way of air movement, light penetration or adequate rain fall to help flush the field. Adding to this problem is a very poor irrigation water supply that will deposit sodium and bicarbonates into the rootzone every time the irrigation system is turned on and because of the overhang a lot of hand watering in perimeter parts of the field is going to be a necessity.

When evaluating a water sample we focus on a number of issues but are really trying to determine if there are any “red flags” in that water that are going to affect growing conditions (see Figure 1). Unfortunately the water sample from Red Bulls Stadium is rich in sodium. The water test identifies the MEQ/L (milli-equivalents per liter of water) which compares the amount of basic cations (calcium, magnesium, potassium and sodium) to each other; in this sample sodium makes up 50% of that relationship and as can be seen on the soil tests the sodium is being deposited into the soil profile.

This much sodium constantly being irrigated into the rootzone will affect soil structure and can create a situation known as sodium induced wilt where sodium enters freely into the cell of the plant creating tremendous stress and a wilting situation. This type of wilt is often mistaken by turf managers as an environmental wilt and more water is applied to overcome it, clearly in this case adding more sodium to the rootzone is not the best answer.

The strategy to prevent this problem without treating the water is to build flushing programs that would include soluble forms of calcium like gypsum and perhaps a good liquid calcium

product. Gypsum applications for this field would be recommended at low rates (5-10 lbs/1000 sq ft) monthly along with a good penetrating wetting agent and possibly a rich humic acid-based soil conditioner. These products would be heavily watered through the soil to help keep the sodium at bay.

The standard soil test (Figure 2) on this site allows us to build a strategy to improve the soil profile and better feed the plant material. As can be seen on the soil test this site is lacking in most everything, not at all untypical of a new sand-based field. The basic cations of calcium, magnesium and potassium are all deficient and products like sul-po-mag, potassium sulfate and a small amount of either high calcium or dolomitic limestone could all become a part of this program.

Phosphorous is also a weak link here and with the stress factors of high sodium and poor nutrient mobility the plants demand for energy increases quite substantially and if phosphorous availability is poor the stress factors to the plant increase. Remember that phosphorous is the “energy molecule” as described by the Krebs Cycle and if phosphorous is not available many of the most basic physiological functions become difficult for the plant to perform.

I like to recommend MAP, the least reactive (and therefore the least likely to tie up) of the soluble phosphorous sources along with small amounts of rock phosphates to provide both solubility and sustainability especially in sand fields. Although rock phosphates may be criticized for not being soluble it will provide a sustainable foundation in the soil (or in this case the soil less medium) where the plant can dissolve the mineral on a steady basis as it needs phosphorous.

Organic matter is very low in this field as well and this needs to improve in order to build soil buffers for water, temperature and to help build a better environment for beneficial micro-

Soil Report

Sample Location			RBA
Sample ID			
Lab Number			26
Sample Depth in inches			6
Total Exchange Capacity (M. E.)			3.75
pH of Soil Sample			6.10
Organic Matter, Percent			0.56
ANIONS	SULFUR	p.p.m.	13
	Mehlich III Phosphorous:	as (P ₂ O ₅) lbs / acre	210
EXCHANGEABLE CATIONS	CALCIUM:	Desired Value	1020
	lbs / acre	Value Found	913
		Deficit	-107
	MAGNESIUM:	Desired Value	200
lbs / acre	Value Found	124	
	Deficit	-76	
POTASSIUM:	Desired Value	200	
lbs / acre	Value Found	76	
	Deficit	-124	
SODIUM:	lbs / acre		73
BASE SATURATION	Calcium (60 to 70%)		60.81
	Magnesium (10 to 20%)		13.76
	Potassium (2 to 5%)		2.60
	Sodium (.5 to 3%)		4.20
	Other Bases (Variable)		5.20
	Exchangable Hydrogen (10 to 15%)		13.50
TRACE ELEMENTS	Boron (p.p.m.)		0.41
	Iron (p.p.m.)		95
	Manganese (p.p.m.)		7
	Copper (p.p.m.)		1.29
	Zinc (p.p.m.)		4.62
	Aluminum (p.p.m.)		140

Figure 2

Spiking the surface of the field as often as possible to break the sealing affect of bicarbonates and sodium will be a huge plus and a carbon based fertility program can help to keep microbial activity high.

organisms. Low organic matter is very common again in these low CEC sand-based fields and it will improve as more roots slough off but if microbial activity is not active enough to constantly digest this ligneous organic matter thatch will build up and biological activity in the rootzone will suffer. Spiking the surface of the field as often as possible to break the sealing affect of bicarbonates and sodium will be a huge plus and a carbon based fertility program can help to keep microbial activity high. (See Figure 3 to see bicarbonates going down through the percentage of sodium.)

The water soluble paste test helps us better understand of what is on the soil colloid how much of it is actually mobilizing into the rootzone so that the plant can take it up. A good analogy here is the standard colloidal test is like a bank's long term CD account where the money won't be available for a period of time and the paste extract test is more like the checking account where money can be drawn on demand.

Here with Red Bull Arena we can see that calcium and magnesium are not mobilizing well. Ideally on this test we shoot for calcium solubility between 40-60 ppm's, magnesium between 8-15 ppm's and potassium between 7-20 ppm's. With this test we see calcium mobility below 20 ppm's and magnesium below 5 ppm's when using the irrigation water but even lower with de-ionized water, which better mimics rain water. This suggests that the plant will not get the needed calcium to build cell walls or enough magnesium needed as a foun-

dition to the photosynthesis process.

These weaknesses can lead to plant stress and susceptibility to pest problems and affect the ability of the turf to recover from the level of play that will be seen on a field like this. Again, the granular applications of gypsum and sul-po-mag will help to provide a level of availability to the plant but a good liquid spray program consisting of NPK, Ca, Mg, traces and some liquid organics are suggested to help the plant get what the soil cannot provide. On low CEC sand-based fields small but frequent applications of all nutrients is important, small monthly applications of the soluble granular and bimonthly applications of the spray program has proven to be very effective.

Culturally a good spiking program is suggested to help keep bicarbonates from building up on the soil surface. Although the water does not show extremely high levels of bicarbonates with the physical pressures placed on a field like this one bicarbonates will build up and the soil surface will become sealed restricting air and water movement. This can lead to localized dry spots, poorer rooting and biological weaknesses affecting nutrient mobility. The soluble calcium program will help here but the use of wetting agents and the physical practice of spiking will help to keep the surface open and air moving through the soil profile. ■

Joel Simmons is the President of Soil First consulting and EarthWorks Natural Organic Products and can be reached at joel@soilfirst.com. Logan Labs is located in Lake View Ohio and can be found on the web at www.loganlabs.com.

Saturated Paste Report			
Sample Location		RBA	
Sample ID			
Lab Number		25865	
Water Used		RBA	
pH		7.4	
Soluble Salts	p.p.m.	219	
Chloride (Cl)	p.p.m.	35	
Bicarbonate (HC03)	p.p.m.	41	
ANIONS	SULFUR	p.p.m.	18.41
	Phosphorous:	p.p.m.	0.85
SOLUBLE CATIONS	CALCIUM:	p.p.m.	17.98
		meg/l	0.90
	MAGNESIUM:	p.p.m.	4.49
		meg/l	0.37
POTASSIUM:	p.p.m.	14.89	
	meg/l	0.39	
SODIUM:	p.p.m.	37.66	
	meg/l	1.64	
PERCENT	Calcium		27.27
	Magnesium		11.34
	Potassium		11.73
	Sodium		49.66
TRACE ELEMENTS	Boron (p.p.m.)		0.03
	Iron (p.p.m.)		1.01
	Manganese (p.p.m.)		0.05
	Copper (p.p.m.)		< 0.02
	Zinc (p.p.m.)		< 0.02
	Aluminum (p.p.m.)		4.29

Figure 3

Fungicides

By **Brandon Horvath, Ph.D.**

DISEASES MIGHT NOT BE THE FIRST PRIORITY FOR TURF MANAGERS (weed control is usually number one), but outbreaks of disease will certainly decrease the appearance of quality turf, so it is important to have a management plan for those diseases that may be a priority. During the last couple of years, chemical manufacturers have developed granular fungicides that are as effective as sprayable products. The key to using them effectively is to know when and how to apply them. Another development in turf management is the use of air-induction and twin jet nozzles to improve coverage and minimize drift. The final development has been the creation of various combination products in order to combat post-patent chemistry, and to streamline

the applications of various products. You can employ each of these developments to gain efficiency in your operations, reduce environmental impact, improve public perception, and increase the efficacy of your applications for disease control.

Sprayers can be expensive. Those that have an adequate budget can usually justify the expense of having a dedicated sprayer to make control applications. However, for those that don't have sprayers, being able to make granular applications that are comparable to their sprayable counterparts would be a large improvement. In the past, granular fungicides were not recommended largely due to their inability to provide comparable control to a spray application. Today, with the development of the dispersible granule, application of a granular that disperses after contact with water makes it possible to achieve disease control as good as the sprayable fungicide. Fungicides on dispersible granules are available for most fungicide mode of action classes, so finding a product that is useful for controlling a disease on your turf — whether cool or warm season — should be pretty straightforward. Fungicides containing the active ingredients azoxystrobin, myclobutanil, propiconazole, thiophanate-methyl, and tridimefon are all currently on the market and available for use. There are also fungicides in the pipeline that are being developed as granulars, and they should also be available in these classes of chemistry. The strobilurins, sterol biosynthesis inhibitors, and benzimidazoles are able to provide disease control for most of the major pathogens that infect

Fungicides

Arysta LifeScience (www.arystalifescience.com)

Product Name	Active Ingredient	For use in/on
DISARM 480 SC	Fluoxastrobin	Anthrachnose (Foliar Infection Phase), Anthracnose (Crown Rot Phase), Brown Patch, Cool Weather Brown Patch, Dollar Spot, Fairy Ring, Gray Leaf Spot, Leaf Spot, Melting Out, Microdochium (Fusarium) Patch, Pink Patch, Powdery Mildew, Pythium Blight, Pythium Root Rot, Pythium Damping Off, Red Thread, Rust, Pink Snow Mold, Typhula Blight Snow Mold, Southern Blight, Spring Dead Spot, Summer Patch, Take-All Patch, Zoysia Patch.
DISARM G (granular)	Fluoxastrobin	Anthrachnose (Foliar Infection Phase), Anthracnose (Crown Rot Phase), Brown Patch, Cool Weather Brown Patch Yellow Patch, Dollar Spot, Fairy Ring, Gray Leaf Spot, Leaf Spot, Melting Out, Microdochium (Fusarium) Patch, Pink Patch, Powdery Mildew, Pythium Blight, Pythium Root Rot, Pythium Damping Off, Red Thread, Rust, Pink Snow Mold, Typhula Blight Snow Mold, Southern Blight, Spring Dead Spot, Summer Patch, Take-All Patch, Zoysia Patch.
DISARM M	Fluoxastrobin/Myclobutanil	Anthrachnose (Foliar Infection Phase), Anthracnose (Crown Rot Phase), Brown Patch, Cool Weather Brown Patch (Yellow Patch), Copper Spot, Dollar Spot, Fairy Ring, Fusarium Patch, Gray Leaf Spot, Leaf Spot, Melting Out, Pink Snow Mold, Typhula Blight Snow Mold, Powdery Mildew, Pythium Blight, Pythium Root Rot, Pythium Damping Off, Red Thread, Rust, Southern Blight, Spring Dead Spot, Summer Patch, Take-All Patch, Waitea Patch, Zoysia Patch Large Patch of Zoysia.

BASF Professional Turf & Ornamental (www.betterturf.com)

Product Name	Active Ingredient	For use in/on
Insignia	Pyraclostrobin	Dollar spot, Field Sandbur, Woolly Cupgrass, Lawn Burweed, Hop Clover, Cudweed, Evening Primrose, Fiddleneck, Filaree, Puncturevine, Pennsylvania Smartweed, Annual Spurge, Chickweed Species, Yellow Woodsorrel.
Trinity	Triticonazole	Anthrachnose, Brown Patch, Brown Ring, Waitea Patch, Dollar Spot, Fusarium Patch, Gray Snow Mold, Large Brown Patch, Necrotic Ring Spot, Pink Snow Mold, Red Leaf Spot, Red Thread, Rust, Summer Patch, Take-All Patch, Zoysia Patch.

Bayer Environmental Science (www.BackedbyBayer.com)

Product Name	Active Ingredient	For use in/on
Armada	Trifloxystrobin, triadimefon	Broad-spectrum disease control in turf
Bayleton	Triadimefon	Broad-spectrum disease control
Compass	Trifloxystrobin	Brown patch, anthracnose, leaf spot, and gray leaf spot
Prostar	Flutolanil	Brown patch, fairy ring, large patch
Triton 70 WDG	Triticonazole	Broad-spectrum disease control
Triton 70 WDG	Triticonazole	Broad-spectrum disease control

Dow AgroSciences (www.DowAgro.com)

Product Name	Active Ingredient	For use in/on
Dithane Rainshield	Mancozeb	Major leaf spots and blights, preventive control of rust, scab, and other key diseases.

turfgrasses. Other granular fungicides may provide disease control, but our experience has been that having a fungicide on a dispersible granule is important for maximum effectiveness.

For those operations that do have a sprayer, the selection of nozzle types has taken on new importance. Research into nozzle selection was first evaluated for disease control on golf course turf such as bentgrass. The findings of this work showed that nozzles that are of the “flat fan type” — such as an air induction nozzle or an XR Teejet — provide the best coverage and this results in an improvement in disease control with fungicides. Nozzles of the “flood jet type” produce coarse droplets that reduce coverage, and thus result in a slight decrease in a fungicide’s efficacy. In my lab, we were interested in evaluating the performance of different nozzles on higher-cut turfs. We evaluated brown patch severity on tall fes-

cue, and only found differences in nozzle types when fungicides were used that might not be optimal products for the disease, or were extended beyond their normal spray interval. The best nozzles in our work were the air induction, the Turbo Twin Jet, and the XR Teejet. Once again, the flood-type nozzles were not as good, presumably due to the lesser coverage. One note on nozzle use: when you think about the value of the products you are applying, you should really check to make sure that the nozzles you are applying them with are in good shape. The cost of brand new nozzles more than makes up for the cost of product wasted due to worn-out or damaged nozzles.

Finally, the development of post-patent products has led some manufacturers to develop value-added and combination products. An example of a combination product is the fungicide Headway by Syngenta. This product contains propiconazole (found in

Banner Maxx) and azoxystrobin (found in Heritage) and provides disease control for brown patch and dollar spot with a single application. This product would be especially useful on Kentucky bluegrass fields concerned about these diseases in addition to summer patch and necrotic ring spot. The key to using a combination product is to evaluate the components of the product and do an honest assessment whether the products in the combination are both needed at the same time. Some products make more sense for certain applications than others, so it is important to perform that assessment. ■

Brandon Horvath, Ph.D. is turf pathologist in the Department of Plant Sciences at the University of Tennessee (UT). His faculty position is funded by the UT athletic department to support turfgrass teaching and research.

Eagle 20EW	Myclobutanil	Dollar spot, anthracnose, summer patch, brown patch and many other turf diseases.
Fore Rainshield	Mancozeb	Broad-spectrum for preventive control of brown patch and 11 other key diseases.

FMC Professional Solutions (www.fmcprosolutions.com)

Product Name	Active Ingredient	For use in/on
Segway	Cyazofamid	Pythium blight, Pythium damping-off, and Pythium root dysfunction

SipcamAdvan (www.sipcamadvan.com)

Product Name	Active Ingredient	For use in/on
Echo 6F ETQ	Chlorothalonil plus pigment	Dollar spot, brown patch, leaf spot, melting out, brown blight, gray leaf spot, anthracnose, red thread, copper spot, stem rust, dichondra leaf spot and others.
Echo 720, Echo Ultimate, Echo Zn	Chlorothalonil	Protects turf and ornamentals from more than 75 diseases.
ProPensity 1.3ME	Propiconazole	Enhances cool-season turfgrass establishment and controls dollar spot, brown patch, anthracnose, summer patch, snow molds, Fusarium patch, powdery mildew, stripe smut, gray leaf spot and others in turf and ornamentals.
Proplant Tee-1-Up WDG	Propamocarb hydrochloride Chlorothalonil, Thiophanate-methyl	Prevents and cures many Pythium diseases, including damping-off, cottony blight, grease spot and root rot in turf. Dollar spot, leaf spot, brown patch, snow molds, powdery mildew, downy mildew and others in turf as well as cedar apple rust, ovulinia blight, anthracnose, black spot, botrytis, scab and other diseases in ornamentals.
Tee-Off 4.5F	Thiophanate-methyl	Anthracnose, summer patch, gray leaf spot, brown patch and other diseases in cool- and warm-season turfgrass, as well as ornamental diseases, including leaf spots and tip blights.

Syngenta (www.greencastonline.com)

Product Name	Active Ingredient	For use in/on
Headway	Azoxystrobin	Controls turf diseases on a variety of turf types, and is expressly formulated to balance each active ingredient for control and optimal efficacy. Available in a 1-gallon container or a 10-gallon LinkPak.
Heritage	Azoxystrobin	Consistently provides exceptional disease control for extended intervals and improves overall turf quality. Controls a broad spectrum of turfgrass diseases, including brown patch, Pythium and snow mold.
Banner MAXX	Propiconazole	Provides effective broad-spectrum disease control in turf and ornamentals. It is a microemulsion concentrate formulation providing excellent tank mix compatibility and stability; no odor, and mixes into a clear solution.

Always read the label. Visit www.greencastonline.com/prod/index.aspx for label information and additional details about each product.

Valent Professional Products (www.valent.com/professional)

Product Name	Active Ingredient	For use in/on
Tourney	Metconazole	Broad-spectrum control of brown patch, anthracnose, dollar spot, fairy ring, snow mold and grey leaf spot, among others.
Stellar	Fluopicolide	A combination of the new chemistry of fluopicolide and the proven power of propamocarb, Stellar is a unique, synergistic fungicide premix that offers excellent control of Pythium due to its novel mode of action.

Insecticides

RICK BRANDENBURG, professor of entomology, North Carolina State, answered several of our questions related to problem pests and insecticide selection and use.

Q: What insect pests will pose the biggest threats this year?

BRANDENBURG: I believe that since we have had good rainfall the past two years throughout much of the Southeast, this will be a good year for white grubs in all turfgrass settings. After the drought of 2007, we have seen a steady increase in white grub abundance and damage, and I see no reason to believe that this trend upward won't continue this year. Since we did not experience really cold temperatures (except Florida) this winter, the mole cricket and fire ant populations should be

normal or above normal. I believe that fall armyworms will continue their progress toward becoming a major pest in the Southeast. Due to the colder-than-normal temperatures, I believe fall armyworms may be a little later this summer and may lead people to a false sense of security that they aren't going to be a problem.

Q: How will current climatological trends impact turf pest infestations this season?

BRANDENBURG: It's hard to predict year-to-year fluctuations in pest populations when we look at individual seasonal weather. However, we do know that certain pests are going to become more prevalent if temperatures elevate. Perhaps the most obvious one is the southern chinch bug on St. Augustine grass.

The hotter it gets, the earlier in the season we will see this pest attacking the turf and it will continue to damage turf later in the fall. Fire ants will continue their spread north as will other traditional pests such as mole crickets. Within the context of this coming season, it's more a matter of what the weather is like that season than climate change over a long period of time. If the summer is

Insecticides

Arysta LifeScience (www.arystalifescience.com)

Product Name	Active Ingredient	For use in/on
ALOFT GC SC and ALOFT GC G (granular)	Clothianidin/Bifenthrin	Annual Bluegrass Weevil (Adult); Annual Bluegrass Weevil (Larvae); Ants, Nuisance (Excluding fire, harvester, pharaoh and carpenter ants); Armyworms; Billbugs; Black Turfgrass Ataenius; Chinch Bugs; Cutworms; European Crane Fly; Grasshoppers; Leafhoppers; Mole Crickets; Pillbugs; Sod Webworms; Sowbugs; Spittle Bug; Sugarcane Grub; White Grubs (Asiatic Garden Beetle, European Chafer, Green June Beetle, Japanese Beetle, Northern Masked Chafer, Phyllophaga spp. [May or June Beetle], Oriental Beetle, Southern Masked Chafer).

BASF Professional Turf & Ornamental (www.betterturf.com)

Product Name	Active Ingredient	For use in/on
Amdro Pro Fire Ant Bait insecticide	Hydramethylnon	Imported fire ants, native fire ants.

Bayer Environmental Science (www.BackedbyBayer.com)

Product Name	Active Ingredient	For use in/on
Allectus	Bifenthrin, imidacloprid	Broad-spectrum insect control
Maxforce FC Fire Ant Bait	Fipronil	Fire ants
CoreTect	Imidacloprid	Tree and shrub insects
Dylox	Trichlorfon	White grubs, mole crickets, sod webworms and cutworms, annual bluegrass weevil.
Forbid	Spiromesifen	Mites
Merit	Imidacloprid	Broad-spectrum grub and tree and shrub control
Sevin	Carbaryl	Broad-spectrum insect control
Tempo Ultra	Cyfluthrin	Broad-spectrum surface-feeding and foliar insects
TopChoice	Fipronil	Fire ants

Dow AgroSciences (www.DowAgro.com)

Product Name	Active Ingredient	For use in/on
Conserve SC	Spinosad	Thrips, leafminers, Eastern tent caterpillars, lepidopterous larvae, armyworms, sod webworms and other pests.

DuPont Professional Products (www.proproducts.dupont.com)

Product Name	Active Ingredient	For use in/on
Acelepryn	Calteryx	Comprehensive control of turf-damaging white grubs, plus surface-feeding insects, including annual bluegrass weevils, billbugs, cutworms and webworms.
Advion Fire Ant Bait	Indoxacarb	Fire ants.
Advion Insect Granule	Indoxacarb	A granular insecticide bait for use to control crickets, including mole crickets, cockroaches, and listed crawling nuisance or occasional invader insect pests.
Provaunt	Indoxacarb	A wide range of caterpillars including armyworms, cutworms, sod webworms, bagworms, fall webworms, gypsy moth caterpillars, tent caterpillars, tussock moth caterpillars, yellownecked caterpillars.

nice and wet, we will see more grubs; if it is dry, we will see fewer. So, within a season, pest infestations are more impacted by short-term weather.

Q: What, if anything, is new or different this year in terms of management options?

BRANDENBURG: I think the recession has really caused turfgrass managers to look at inputs like insecticides from a more critical viewpoint. Many have looked at reduced rates, more effective timing, generic or off-patent products, and to look more critically at the newest products. Although we have seen numerous new, good products in recent years, I think the most critical differences are the time and effort put into product selection and use to be most cost effective.

Q: Can you share with our readers any recent research results that could potentially impact how they manage specific insect pests?

BRANDENBURG: We have found time and time again that really understanding the life cycles of the key pests in your area is so critical in timing insecticides and obtaining good control. However, in the Southeast we are seeing the development of new pest problems. Hunting billbugs and sugarcane beetles, to name just a couple of examples, are increasing each year as pests concerns.

I think this is simply a reflection that the management of high-quality turfgrass in the Southeast, and the recent population growth is really a fairly recent concept. It has only been the past 25 to 30 years or so that high-quality turfgrass has become a major com-

modity in the Southeast, and I believe that the pests are finally figuring it out. The increased presence of earthworms and moles are all a reflection of using more environmentally sound products. I think we will continue to see some pest shifts during the coming years and it will require turfgrass managers to keep their education up to date.

Q: What are some general tips that turf and landscape professionals should keep in mind regarding insecticide selection and use?

BRANDENBURG: If you take the time to identify your pest problems, know their biology and ecology, and monitor their development, there are products available that will work as good as, or better than, any of the products of the past. ■

FMC Professional Solutions (www.fmcprosolutions.com)

Product Name	Active Ingredient	For use in/on
Talstar XTRA Granular (new launch May 2010)	Bifenthrin + Zeta-Cypermethrin	Surface-feeding pests, including fire ant colonies.
Talstar PL Granular	Bifenthrin	Surface-feeding pests, including ants, spiders, etc. Controls fire ant colonies, too.
Talstar EZ Granular	Bifenthrin	Surface-feeding pests, including ants, spiders, etc. Controls fire ant colonies, too.
Talstar Pro	Bifenthrin	Surface feeding pests, including ants, spiders, etc. Controls fire ant colonies, too.
BaseLine	Bifenthrin	Surface feeding pests, including ants, spiders, etc. Controls fire ant colonies, too.
Onyx and Onyx Pro (Restricted Use for Nursery market)	Bifenthrin	Provides reliable long-term control of borers and beetles
Aria	Fonicamid	Through contact and ingestion, the active ingredient in Aria stops both adult and immature aphids from feeding within one hour of treatment, and eliminates them within three to five days as a result of dehydration and starvation.
Astro	Permethrin	Borers, beetles, leafhoppers, chinch bugs, cutworms and over 40 other damaging tree and lawn pests.

SipcamAdvan (www.sipcamadvan.com)

Product Name	Active Ingredient	For use in/on
Enforce	Imidacloprid	Delivers long-lasting white grub protection and is also effective against mole crickets, billbug larvae, annual bluegrass weevils, cutworms, chinchbugs and European crane flies. Controls a broad range of pests in landscape ornamentals, flowers, fruit and nut trees, groundcovers and interiorscapes.

Syngenta (www.greencastonline.com)

Product Name	Active Ingredient	For use in/on
Meridian 0.33G and 25 WG	Thiamethoxam	Manages a broad spectrum of grubs and insects on turf. Meridian controls soil and foliar pests at very low rates, through both contact and ingestion activity. It also is effective and suitable for use on trees and shrubs. Insects controlled include soil pests such as billbugs and white grubs (such as Japanese beetles, oriental beetles, and European, Southern and Northern masked chafer); and foliar pests such as aphids, whiteflies, mealybugs and leafhoppers among many others.
Simitar CS	Lambda-cyhalothrin	Advanced-generation pyrethroid technology in a proprietary formulation for use on ornamentals and lawns in landscaped areas around residential, institutional, public, commercial and industrial buildings, parks, recreational areas and athletic fields. Scimitar controls turf insects such as chinch bugs, sod webworms, cutworms and bluegrass billbugs. Always read the label. Visit www.greencastonline.com/prod/index.aspx for label information and additional details about each product.

Valent Professional Products (www.valent.com/professional)

Product Name	Active Ingredient	For use in/on
Safari	Dinotefuran	Controls a broad spectrum of tough and invasive pests, including emerald ash borer (EAB), hemlock woolly adelgid (HWA), mealybug, leafminer and armored and soft scale, among many others.
Arena	Clothianidin	Provides preventive and curative control of white grubs and a broad spectrum of other pests, including scale, billbugs, pyrethroid-resistance chinch bugs, among others—all with a single application.

Herbicides

By Dr. James T. Brosnan
and Greg K. Breeden

YEARS OF RESEARCH are completed before herbicides become available for sale. When used properly, most of the herbicides available in today's market are highly effective. It is integral that these materials be applied according to label instructions using calibrated equipment. Failure to do so can lead to poor performance and wasted revenue. Proper herbicide use is also incumbent upon applying the product at a time of year when it has shown to be most effective. For example, most preemergence herbicides will not effectively control crabgrass (*Digitaria* spp.) when applied after crabgrass plants have emerged from the soil. Be sure to consult a

cooperative extension specialist from a local university for more information on proper herbicide application timing.

Although herbicide applications provide effective weed control, implementing proper cultural practices will also help prevent future weed infestations. Weeds only invade turf stands if there is a void in the canopy in which to do so. Turf managers should ensure that everything possible is being done to maintain dense, vigorous turf growth. Practices such as selecting traffic-tolerant cultivars, applying fertilizers to meet soil test recommendations, sufficiently irrigating to meet plant needs, mowing at a proper height of cut, and aerifying regularly all serve to maximize turf vigor and density, consequently reducing the likelihood of weed infestations. Implementing proper cultural practices to provide plant competition against weeds is essentially a means of preventative weed control. In many cases, increased plant competition from combining herbicide applications with cultural practices like aeration or fertilization can lead to greater weed control than simply applying herbicides by themselves.

Chemical manufacturers seem to be aware of the challenges faced by

Herbicides

BASF Professional Turf & Ornamental (www.betterturf.com)

Product Name	Active Ingredient	For use in/on
Onetime	Dicamba, MCPP-P, Liquid Quinclorac	Barnyardgrass, Crabgrass, Dollarweed, English Daisy, Foxtail, Ground Ivy, Kikuyugrass, Oxalis, Speedwell, Spurge, Torpedograss, Virginia, Buttonweed, Wild Garlic/Onion, Wild Violet.
Drive XLR8	Liquid Quinclorac	Bindweed, Clover, Crabgrass, Dandelion, Dollarweed, Foxtail, Kikuyugrass, Signalgrass, Speedwell, Torpedograss.
Pendulum AquaCap	Pendimethalin	Field Sandbur, Woolly Cupgrass, Lawn Burweed, Hop Clover, Cudweed, Evening Primrose, Fiddleneck, Filaree, Puncturevine, Pennsylvania Smartweed, Annual Spurge, Chickweed Species, Yellow Woodsorrel.

Bayer Environmental Science (www.BackedbyBayer.com)

Product Name	Active Ingredient	For use in/on
Acclaim Extra	Fenoxaprop-p-ethyl	Crabgrass and goosegrass
Celsius	Iodosulfuron-methyl-sodium, thiencazuron-methyl, dicamba	Grassy and broadleaf weed control in warm-season turf
Finale	Glufosinate-ammonium	Non-selective broad-spectrum grassy and broadleaf weed control
Prograss	Ethofumesate	Poa annua control and bermudagrass suppression in St. Augustine
Revolver	Foramsulfuron	For control of cool-season grasses such as poa and goosegrass
Ronstar	Oxadiazon	Goosegrass, crabgrass, annual bluegrass
Sencor	Metribuzin	Goosegrass, broadleaf weed control

Dow AgroSciences (www.DowAgro.com)

Product Name	Active Ingredient	For use in/on
Confront	Triclopyr/Clopyralid	Post-emergence control of 35 difficult to control broadleaf weeds.
Dimension	Dithiopyr	Pre- and post-emergence control of crabgrass; preemergence control of 40 annual grassy and broadleaf weeds.
Gallery	Isoxaben	Preemergence control of 95 broadleaf weeds, including dandelion, clover, plantain and thistle.
Kerb	Pronamide	Pre- and early post-emergence control of Poa annua and other grassy and broadleaf weeds.
LockUp	Penoxsulam	Post-emergence control of key broadleaf and grassy weeds, including white clover and dollarweed.
Lontrel	Clopyralid	Post-emergence control of broadleaf weeds, including clover and thistle.
Scythe	Pelargonic Acid	Non-selective post-emergence control of annual and perennial grasses, weeds and mosses.
Snapshot	Trifluralin/Isoxaben	Preemergence control of 111 broadleaf and grassy weeds in landscape ornamentals.
Team Pro	Benefin/Trifluralin	Preemergence control of broadleaf and grassy weeds.
Turfion Ester	Triclopyr	Broad-spectrum post-emergence control of hard-to-control weeds, including oxalis, wild violet, spurge and ground ivy.

DuPont Professional Products (www.proproducts.dupont.com)

Product Name	Active Ingredient	For use in/on
TranXit	Rimsulfuron	Spring use of TranXit controls ryegrass to give bermudagrass the opportunity for more rapid and complete reestablishment after winter dormancy. Then follow-up with a fall application of TranXit to control annual bluegrass prior to overseeding for the winter.

Chemical Resource Guide (Herbicides)

turf managers and have begun to produce new herbicides designed on maximizing the effectiveness of a single herbicide application. These herbicides typically combine two or more active ingredients that have been sold individually into a single formulated product. Examples include Solitare (sulfentrazone + quinclorac) and Onetime (quinclorac + MCPP + dicamba). Both of these products offer postemergence control of crabgrass (*Digitaria* spp.) and various broadleaf weeds with a single application. Using a product with a wide weed control spectrum will reduce the number of herbicide applications required during the season.

Tenacity (mesotrione) is an herbicide that exhibits activity against broadleaf and

grassy weeds in cool-season turfgrass. Although this product has been labeled for use on golf courses for several years, new labeling will allow for use on sports fields beginning in 2010 (D. Shepard and D. Mosdell, personal communication). Individuals managing cool-season sports turfs will benefit greatly from this new labeling in that Tenacity will provide an option for both broadleaf and grassy weed control during the seeded establishment of tall fescue (*Festuca arundinacea*), Kentucky bluegrass (*Poa pratensis*), and perennial ryegrass (*Lolium perenne*). Research at the University of Tennessee has observed that sequential applications of Tenacity provide more effective control of crabgrass, goosegrass (*Eleusine*

indica), and winter annual broadleaf weeds than single applications.

The guide that follows details many of the herbicides labeled for use on warm- and cool-season turf. Always refer to the product label for specific information on proper product use, tank-mix compatibility, and turfgrass tolerance. For more information on turfgrass weed control in the transition zone, visit <http://tennesseeturfgrass.weeds.org>. ■

Dr. James T. Brosnan is assistant professor — Turfgrass Weed Science at the University of Tennessee; Greg K. Breeden is weed science extension assistant at the University of Tennessee.

FMC Professional Solutions (www.fmcprosolutions.com)

Product Name	Active Ingredient	For use in/on
Echelon	Sulfentrazone + Prodiamine	Preemergence crabgrass, sedge, and goosegrass. Fall applications for the control of poa annua.
Dismiss	Sulfentrazone	Warm and cool season turf: Fast, visible postemergence control of sedges, including yellow nutsedge, purple nutsedge (2 apps), and green kyllinga.
Dismiss South	Sulfentrazone + Imazethapyr	Warm season turf (excluding St. Augustine). Fast, visible postemergence control of sedges, with a focus on purple nutsedge.
Dismiss CA	Sulfentrazone	Fast, visible postemergence control of sedges, including yellow nutsedge and green kyllinga.
Solitare	Sulfentrazone + Quinclorac	Postemergence sedges, crabgrass, and broadleaf weeds in a single product.
QuickSilver	Carfentrazone	Silvery Thread Moss (more golf related). Broadleaf tank-mix partner to speed up the results of other products.

SipcamAdvan (www.sipcamadvan.com)

Product Name	Active Ingredient	For use in/on
Atrazine	Atrazine	Season-long control of annual grassy and broadleaf weeds in warm-season turf, conifers and ornamentals.
Cavalcade PQ	Prodiamine, Quinclorac	Preemergence and extended postemergence control of grassy and broadleaf weeds.
Cavalcade 65WDG	Prodiamine	Long-residual preemergence control of 30 grassy and broadleaf weeds, including crabgrass, Poa annua, goosegrass, prostrate spurge, common purslane and knotweed.
Eject 4L	Quinclorac	Extended postemergence control of grassy and broadleaf weeds, such as crabgrass (including mature plants), foxtail, barnyardgrass, clover, dandelion, black medic, wild violet and others.
Sim-Trol	Simazine	Both preemergence and postemergence control of nearly 50 annual grassy and broadleaf weeds in warm-season turfgrass and ornamental.

Syngenta (www.greencastonline.com)

Product Name	Active Ingredient	For use in/on
Fusilade II	Fluazifop-P-butyl	Controls a long list of both perennial and annual grass weeds in a variety of turf and landscape areas. Extremely fast and effective, and can be applied over-the-top or as a directed spray without damaging valuable ornamental plantings. It can also be used at reduced rates to safely remove Bermudagrass from tall fescue and zoysia grass.
MonumentR 75WG	Trifloxysulfuron-Sodium	Selective post-emergent herbicide for the control of sedges, certain grasses and broadleaf weeds in bermudagrass and zoysiagrass. May be applied to bermudagrass and zoysiagrass on golf courses, sod farms, sports fields, residential properties (except in California) including home lawns, and other non-residential turf areas.
DepartureTM	Glyphosate	A nonselective foliar systemic herbicide for control of a broad spectrum of emerged annual and perennial grass and broadleaf weeds and unwanted woody brush and trees. It can be used in a wide range of nonagricultural use areas.

Always read the label. Visit www.greencastonline.com/prod/index.aspx for label information and additional details about each product.

Valent Professional Products (www.valent.com/professional)

Product Name	Active Ingredient	For use in/on
SureGuard	Flumioxazin	Provides excellent, long-lasting preemergent control of annual broadleaf and grassy weeds such as bittercress, chickweed, groundsel, spurge, oxalis, crabgrass and many others.
BroadStar	Flumioxazin	BroadStar is an odorless and dust-free granular preemergence herbicide that eliminates a broad spectrum of annual broadleaf and grassy weeds such as spurge, bittercress, oxalis, common groundsel and crabgrass, among many others.
Velocity	Bispyribac-sodium	Gradually eliminates Poa annua and Poa trivialis from creeping bentgrass and effectively transitions a Poa-dominated mixed stand of turf to pure bentgrass. Also suppresses dollar spot and controls other broadleaf weeds.